REMARKS

Please reconsider this application in view of the amendments and the remarks. Applicant thanks the Examiner for carefully reviewing this application.

Preliminary Matter

Pursuant to a substitute power of attorney filed herewith, please direct all future communications to Osha Liang LLP (customer number **22511**), with attorney docket No. **17452/016001**.

Disposition of the claims

Claims 1-22 are pending. Claim 1 is independent. The remaining claims depend, directly or indirectly, from claim 1.

Claim amendments

Claims 1-15 and 17-22 have been amended to clarify the inventions recited. No new matter is introduced by these amendments.

Applicant notes that these amendments are to clean up the languages in the claims; they do not change the scope or the subject matter of the original claims. Therefore, entry of these amendments is respectfully requested.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 1-22 are ejected under 35 U.S.C. § 103(a) as being obvious over Seibel (U.S. 6,975,898) in view of Barbato et al. (U.S. 2003/0130562). Claims 1-22 have been amended. To the extent that this rejection may still apply to the amended claims, this rejection is respectfully traversed.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be shown or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ (C.C.P.A., 1074). Furthermore, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)." *See also*, MPEP § 2143.01. (emphasis added).

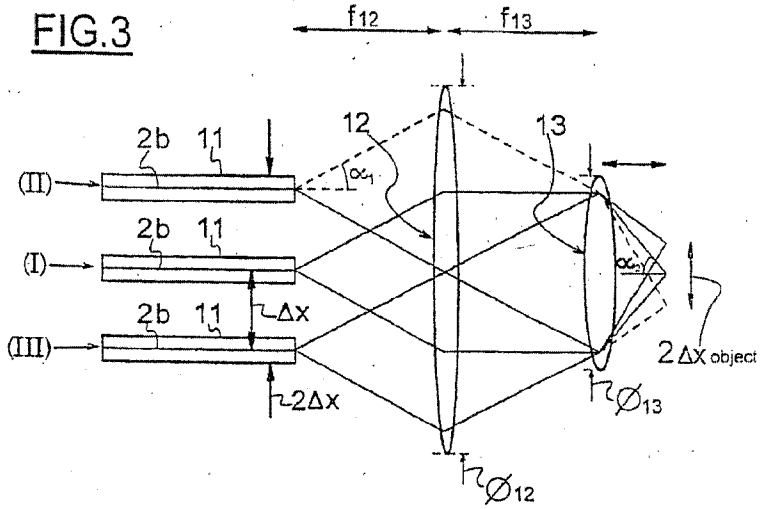
If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Furthermore, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (C.C.P.A. 1959). See also, M.P.E.P. § 2143.01(VI).

The present invention relates to a miniature confocal optical head and a system having such an optical head for confocal imaging. As illustrated in FIG. 3 (reproduced below), an

optical head in accordance with embodiments of the invention includes a point light source (2b), a first optical device (12) and a second optical device (13). The point light source (12b) may be provided by an optical fiber and an external light source (e.g., a laser). The first and second optical devices (12,13) constitute an optical system to focus the excitation beam from the light source (2b) at a point below the surface of a sample.

The first or second optical device (12,13) each may be a single lens, a doublet of lenses, or any other usual optical means (paragraph [0051][1] of the published application No. 2006/0056017). The various characteristics (e.g., magnification and numerical aperture) needed for the first and second optical devices to focus the excitation beam at a point below the surface of a sample are described in paragraphs [0051] and [0052], and two specific examples are provided (paragraphs [0059] – [0065] and [0075] – [0081]).

FIG.3



[1] All paragraph numbers refer to those in the published application No. 2006/0056017.

In confocal imaging, the focused beam needs to be scanned pixel-by-pixel on the confocal plane. In accordance with embodiments of the invention, the scanning is achieved by moving two objects in the optical head in two different directions (e.g., X and Y axis scanning; or line-and-column scanning). The two objects may be, for example, one of the following combinations: (i) the light source (2b) and the first optical device (12)), (ii) the light source (2b) and the second optical device (13), or (iii) the first optical device (12) and the second optical device (13).

FIG. 3 illustrates a scanning mechanism involving the light source (2b) and the first optical device (12). As illustrated, the light source (2b) (at position I when resting) may be moved to position II or III by a micro-movement mechanism, such as a Piezoelectric positioner. The first optical device (12) may be moved, for example, by MEMS. These two movements are in orthogonal directions in order to achieve the X-Y scanning. In addition, the combined scanning rates are preferably fast enough (e.g., 10 images per second or more) to afford real time imaging for video display.

As noted in the present specification, the X and Y translational mechanism provides lateral scanning of the light, without imparting angular movement. This has the advantages of preserving an axial illumination of the specimen and minimizing the diameter of the optical head. (paragraph [0019] of the published application No. 2006/0056017).

Specifically, the amended claim 1 includes, *inter alia*, the limitations: "an optical system comprising a first optical device and a second optical device capable of causing said

excitation beam to converge at an excitation point situated in a subsurface plane in a specimen, . . . and a scanning mechanism for scanning said excitation point so as to describe a field of view in said subsurface plane in two perpendicular scanning directions, wherein the scanning mechanism comprises a rapid line scanning device and a slow column scanning device, wherein at least one of the rapid line scanning device and the slow column scanning device comprises a micro-electro-mechanical system (MEMS) capable of moving at least one of the first optical device and the second optical device in a direction perpendicular to said optical axis."

In contrast, Seibel discloses a system that uses directed and scanned optical illumination provided by a scanning optical fiber or light waveguide that is driven by a piezoelectric or other electromechanical actuator. (Abstract). Thus, Seibel teaches a scanning method that scans the light source (i.e., the optical fiber) by pivoting the optical fiber. Seibel does not teach a method that scans a lens used to focus the light on the sample. By pivoting the optical fiber, Seibel performs an angular scanning, which would not have the advantages noted in the present specification – i.e., an axial illumination of the specimen and minimizing the diameter of the optical head.

In addition, because Seibel relates to general microscope imaging, not confocal imaging, it does not teach the use of an optical system for focusing the excitation beam at a point below the surface of a sample. One of ordinary skill in the art would know that confocal imaging results from a combination of two factors: (i) converging beam focused at an excitation point in a subsurface plane in the sample, and (ii) spatial filtering in the backward direction (on the collected photons coming back from the sample). The focusing ability allows a confocal system to focus the

light at different depths below the surface of the sample, making it possible to perform 3D imaging. The filtering function is usually provided by a pinhole. In the embodiments of the present invention, the optical fiber used for illumination also acts as a pinhole. The focusing and filtering capability gives the system its optical slicing performance, i.e. its confocal property.

Seibel does not disclose a confocal system because it does not have any focusing optics to focus the excitation beam at a point in the sample. Instead, Seibel's system would shine a divergent light on the surface of the sample. Specifically, Seibel fails to teach, "an optical system comprising a first optical device and a second optical device capable of causing said excitation beam to converge at an excitation point situated in a subsurface plane in a specimen," as required by the amended claim 1.

Because Seibel fails to teach an optical system comprising a first optical device and a second optical device, Seibel also fails to teach or suggest, "micro-electro-mechanical system (MEMS) capable of moving at least one of the first optical device and the second optical device in a direction perpendicular to said optical axis," as required by the amended claim 1.

Barbato et al. does not provide that which is missing in Seibel. Barbato et al. discloses an imaging device having the light source and/or a photo-sensor moved to scan an image area. Specifically, the movement mechanism is a platform that can be moved in two dimensions. However, like Seibel, Barbato et al. is concerned with general imaging, not confocal imaging. Therefore, Barbato et al. also fails to teach an optical system comprising a first optical device and a second optical device for focusing the excitation beam at a point under the surface of a sample. For

example, Barbato et al. teaches that "according to the illustrative embodiment of FIGS. 2A and 2B, the light source assembly lenses (e.g., 122b and 123b) are fixed focal length lenses" (paragraph [0040] in Barbato et al.) and that, in the embodiment shown in FIG. 3, "the light source assembly 122 employs a fixed focal length lens 122b and the photo-sensor assembly 124 employs a wide angle lens 124b." (paragraph [0041] in Barbato et al.).

Specifically, like Seibel, Barbato et al. fails to teach, "an optical system comprising a first optical device and a second optical device capable of causing said excitation beam to converge at an excitation point situated in a subsurface plane in a specimen," as required by the amended claim 1. Furthermore, Barbato et al. also fails to teach, "micro-electro-mechanical system (MEMS) capable of moving at least one of the first optical device and the second optical device in a direction perpendicular to said optical axis," as required by the amended claim 1.

Furthermore, Seibel teaches an angular pivoting mechanism to move an optical fiber, whereas Barbato et al. teaches a moving platform mechanism for moving a light source and/or a detector. These are different mechanisms based on different operating principles. "[I]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (C.C.P.A. 1959). See also, M.P.E.P. § 2143.01(VI).

For reasons set forth above, Seibel and Barbato et al., whether considered separately or in combination, would not teach every limitations of claim 1. Therefore, claim 1 is patentable

over Seibel in view of Barbato et al. Dependent claims 2-22 should also be patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 17452/016001).

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Respectfully submitted,

By _____

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